Sustainable metals management: Australia

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Overview

Australia and Sydney

Sustainability issues with metals

Status of metals cycling in Australia

Sustainable metals use research questions and goals

MFA on metals in Australia and Sydney:

- Cadmium
- Copper
- Aluminium

The future

Australia

22.7million, growing at 1.5 – 2%pa …36 - 42M by 2050?

GDP: USD 1-1.3 Trillion, growing at 2-4%pa; Number 12 – 14 in G20

HDI: No 2 in the world.

Manufacturing declining; Mining significant; Services: 70% employt, GDP.

5% unemployment..stable

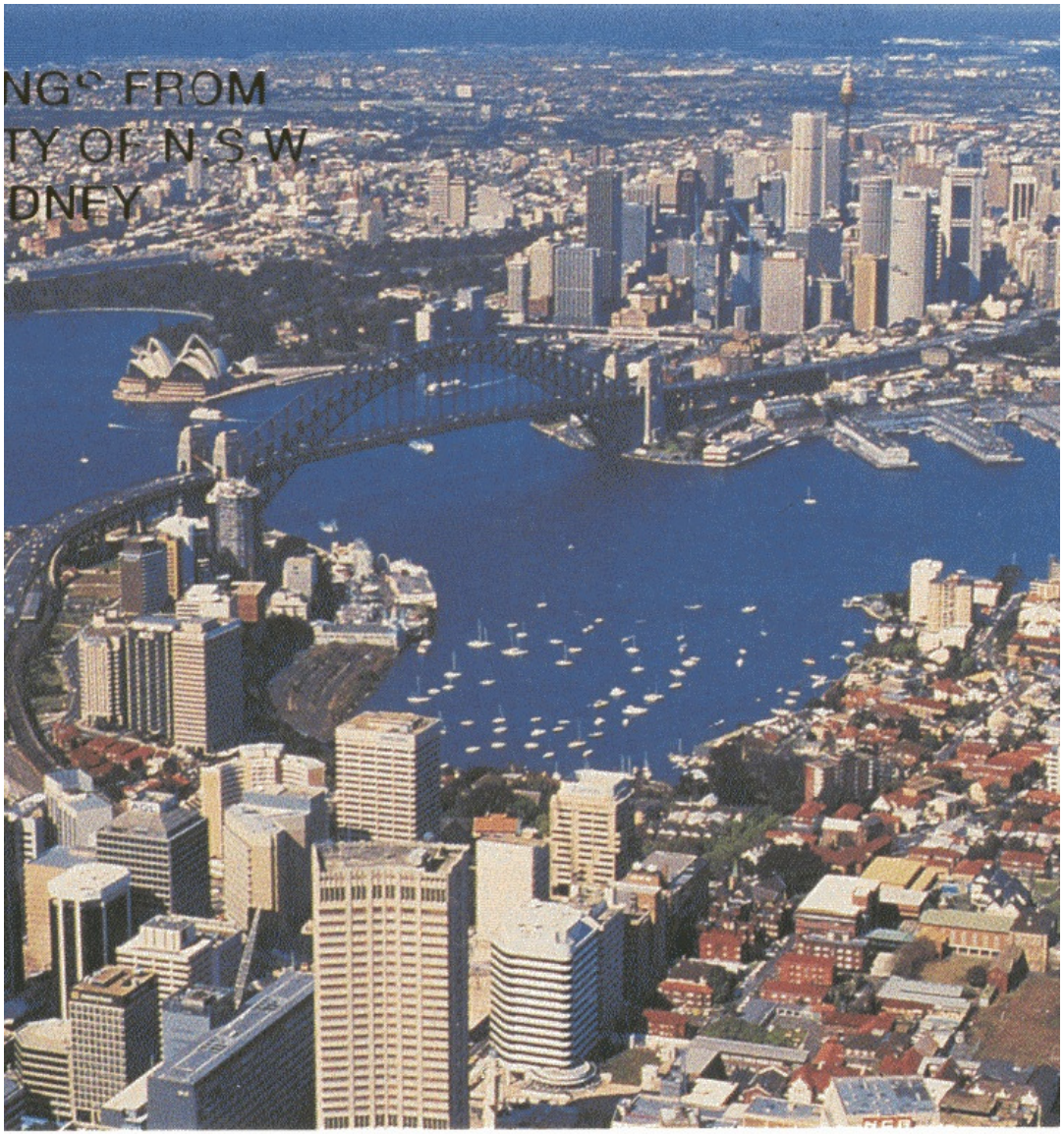
Sydney

4.6M …7.5M by 2050?

A growing city…1.5% p.a.

77% of State of NSW population

Australia'a oldest and largest city.



Metals Sustainability: from a materials management perspective

Need materials to make goods to satisfy service needs and wants

Resource conservation and environmental protection

Need an account of materials and energy at different scales:

corporate -> regional -> national -> global

Quantify material flows comprehensively:

resources -> mine wastes

-> materials -> goods ->use emissions

-> end of life goods

Non-renewable metals: supply and emission issues

Increasing consumption rates of metals

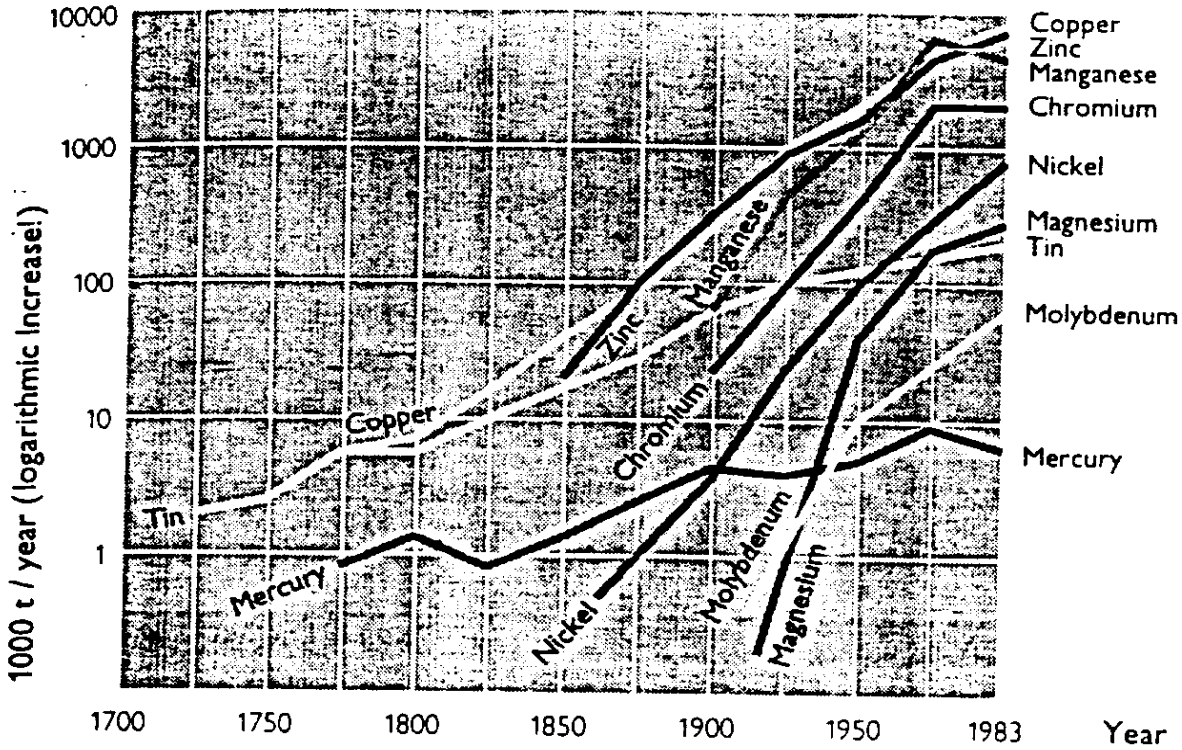
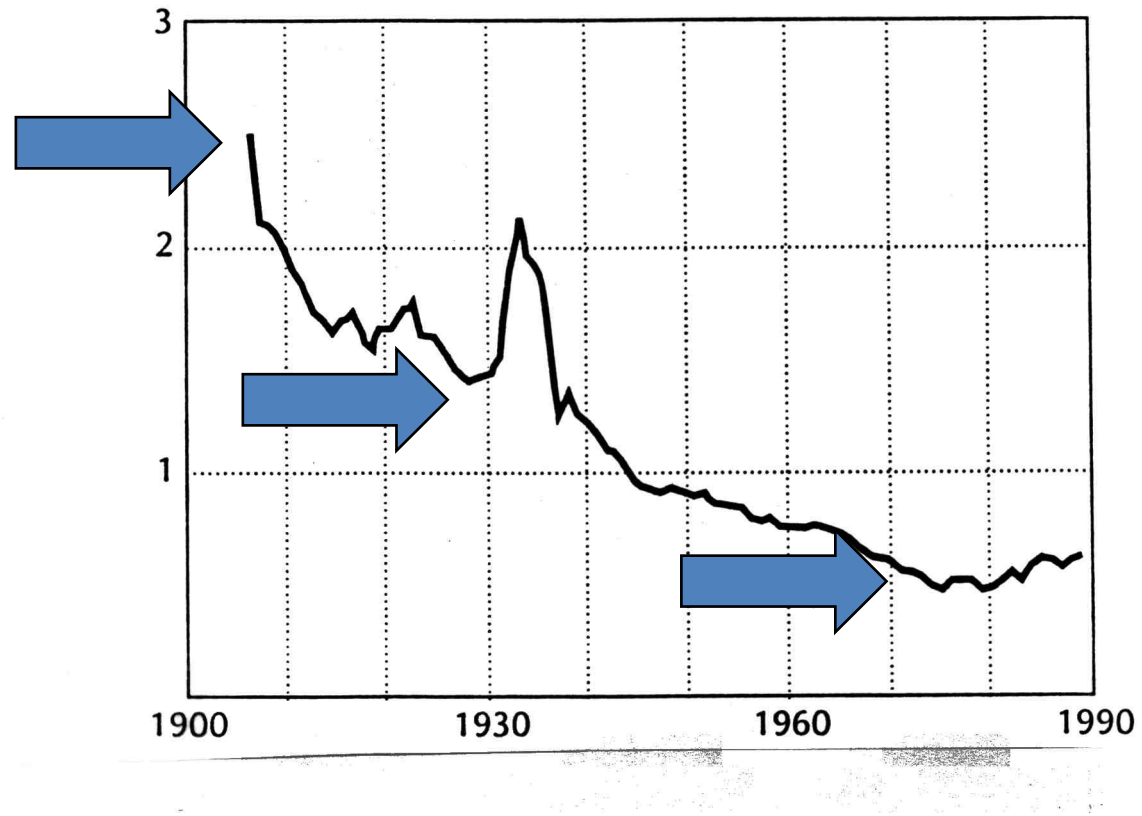


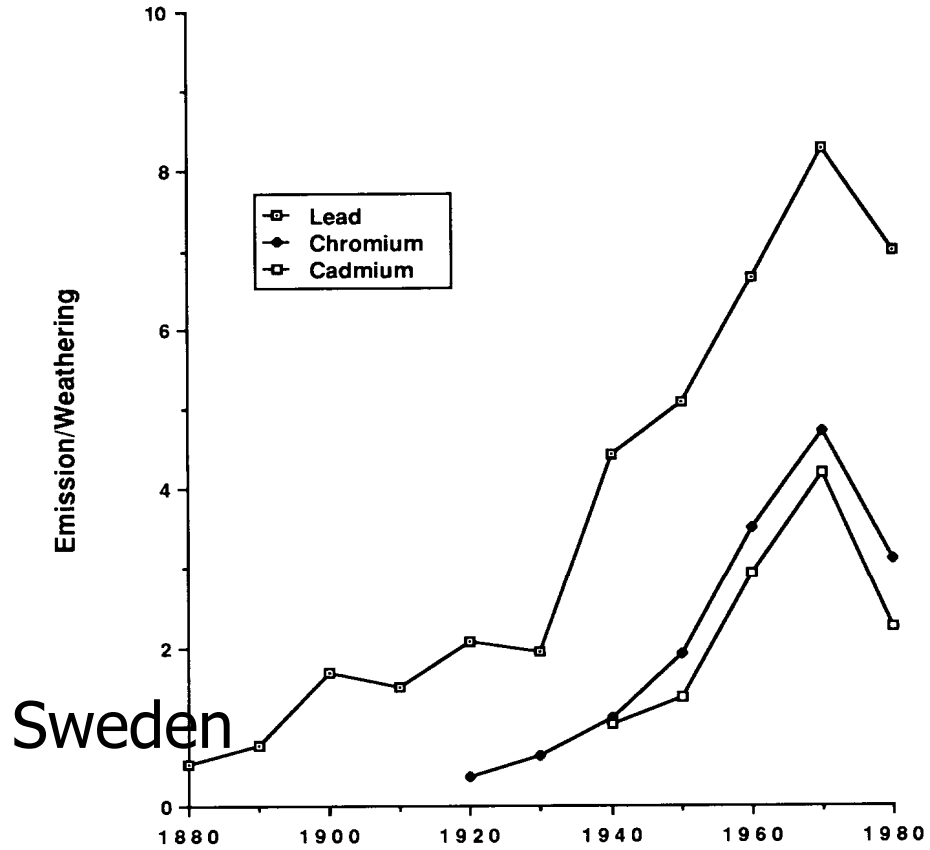
Fig. 1. The explosive increase of material intensity during two centuries: worldwide metal production in 1000 t/year. Note the logarithmic scale. Source: Ayres (1991).

Decreasing availability of ores; finite resources

THE DECLINING QUALITY OF COPPER ORE MINED IN THE UNITED STATES, 1906–1990



Dissipative and waste emissions to the environment



Sweden

Metals in Australia

Australian context:

- Growing cities
- Mining ores and concentrates: contaminants
- Little and declining manufacturing
- Asian trading zone, high labour costs, shortage of skilled labour.

Status of Metals cycling in Australia

National Level

State of NSW level

Corporate Level

Professional Associations

Limited quantification of metals cycling: available data.

Critique and Need for a more comprehensive system.

National Level:
Product Stewardship Act 2011

A national law, with implementation at national level

Product stewardship, but can be modified to EPR

Covers waste minimization through life cycle of good

A good can be included if:

- it contains hazardous substances
- **there is the potential to improve resource recovery**
- can protect the environment or humans.

By voluntary product stewardship

By co-regulatory product stewardship

By mandatory product stewardship.

Initially TV and computers by end of 2011.

Precious metals, but also Fe and Al.

New South Wales

WARR Act 2001

WARR Strategy 2003, 2007, 2011:

		2002–03	2004–05	2006–07	2008–09	2014 Target
SMA	Municipal	33%	37%	42%	51%	66%
	C I	33%	35%	42%	50%	63%
	C&D	68%	66%	70%	77%	76%
	Overall	48%	49%	54%	62%	

Priority Wastes:

e-Waste: batteries, computers, mobiles, other electrical, TV…-> Product Stewardship Act

See metals numbers below

Corporations

Waste companies: Veolia, SITA, Transfield Cleanaway:

waste collection, recycling, treatment, disposal to Councils and corporations

E-waste: Sims, Close the Loop…charge councils, corporations for recycling end of life goods

hand sort/dis-assemble, shredding, Fe ,Al, Pb recovery; PCBs to Korea or Europe.

Whole of life approach:

LABs, Computers, Consumer Batteries

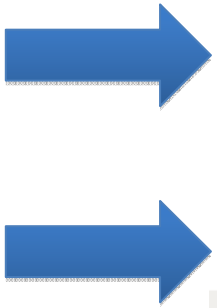
Alcoa: also buys back end of life Al to melt to sell on to primary produced Al customers.

Fuji-Xerox photocopier machines to Thailand and then Japan for recycling, treatment

Fuji-Xerox


Fuji Xerox (China)
Integrated Recycling Centre
Remanu-
factured
cartridges/
hazardous
waste
Fuji Xerox (Japan)
Asset Recovery
Remanu-
factured parts
for resale
Fuji Xerox (Thailand)
Asia Pacific Integrated
Recycling Centre
End of life
equipment &
cartridges
Product
Customer
Fuji Xerox Australia
Eco-Manufacturing Centre
Equipment
cartridges
parts

Professional Associations: WMAA



NSW/ACT

- Compost NSW
- Construction & Demolition
- Resource & Energy Recovery
- Landfill
- Biosolids
- Educators
- Metal Recycling
- Alternate Waste Technologies
- Young Professionals
- Strategic Planning and Implementation
- Hunter Region Group
- NSW Carbon Committee
- Industrial Ecology

VIC

- Compost VIC
- Landfill
- Educators
- Young Professionals
- Hazardous Waste
- Resource & Energy Recovery
- VIC Carbon Committee

WA

- Compost WA
- Landfill
- Educators
- Young Professionals
- WA Carbon Committee
- Construction & Demolition
- Commercial & Industrial
- Resource & Energy Recovery

QLD

- Compost QLD
- Landfill
- C&D
- Educators
- Energy from Waste
- QLD Carbon Committee

SA/NT

- Compost SA
- Landfill
- SA Carbon Committee
- Waste Educators (SA)

Industrial Ecology in WMAA

"What is Industrial Ecology?

Industrial Ecology promotes enhanced sustainability by stimulating innovations in the reuse of waste materials. ***The wastes or by-products of one industry are used as inputs in another industry, thereby closing the material loop of industrial systems and minimizing wa****ste.*

Waste and by-products must be reused as input materials in a systematic way to close the material cycle as efficiently as possible;

Loss caused by dispersion must be minimized. This refers to products such as fertilizers, tyres, or solvents that may be dispersed into the environment and there is an obvious need to minimize the harmful effects and design of these products.

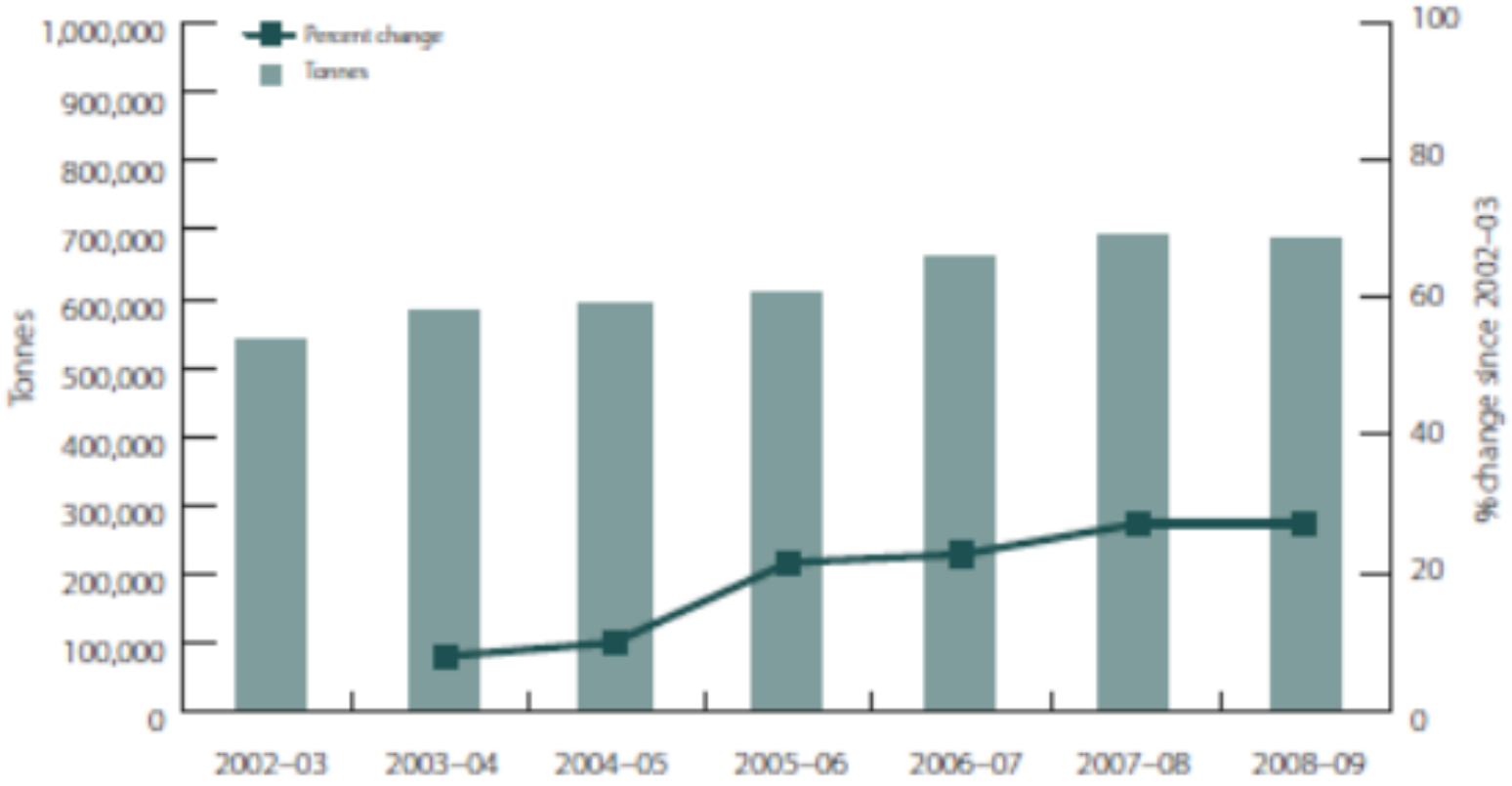
Maintaining the material balance. In material flow terms, this means ensuring that not more of a particular resource is used in one year than the amount of the resource produced in that same year.

Keeping renewable and non-renewable resources as long as possible in the material cycles, unless this is not environmentally desirable.

Energy must rely less on fossil hydrocarbons, while stimulating the use of renewable energy as much as possible."

Data on metals recycling: conventionally limited
Municipal waste focus (but small in overall metal flows)

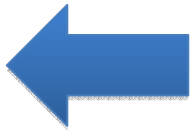
Figure B6: Annual dry recyclables collected at kerbside (tonnes) in the NSW – 2002–03 to 2008–09



Municipal waste recycling…

In Sydney, on average, each person set aside 102.4kg of material for recycling in 2008–09 compared with 89.2kg in 2002–03. This is 3.6 kg per person per year less than in 2006–07. Recovery per household now averages 285kg per year. In 2008–09, an average person in the SMA recycled:

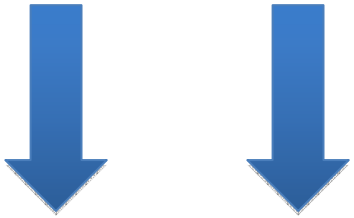
- 65.6 kg of paper and paper products;
- 27.7 kg of glass;
- 6.2 kg of plastic;
- 2.4 kg of steel cans and;
- 0.5 kg of aluminium cans[5].



2006 Australian Council of Recyclers recovery rates: composite of MW + CI +CD

Total annual recovery by ACOR members and extrapolations for Australia (tonnes/yr)

Material Type	ACOR Performance	Net Australian Performance
Paper/cardboard	2,275,000	2,645,349
Glass	500,000	581,395
Ferrous	3,000,000	3,488,372
Non Ferrous	300,000	348,837
PET	23,949	27,848
HDPE	35,745	41,564
Concrete	3,100,000	5,000,000
Mixed C & D	205,000	unknown
Total	**9,439,694**	**12,133,365**



Resource conservation – mass of resource (tonne equivalents)

State	Paper/ cardboard	Glass	Ferrous	Aluminium	PET	HDPE
NSW	938,466	158,413	1,312,665	547,500	18,914	28,467
Vic	1,003,010	70,752	1,183,618	467,545	21,584	32,486
Qld	522,529	57,890	709,772	190,920	10,789	16,238
SA	164,750	40,232	414,637	136,752	4,511	6,789
WA	224,924	17,401	325,947	130,688	2,038	3,067
Tas	58,242	9,480	97,968	38,945	1,264	1,902
NT	25,896	2,080	41,929	16,453	495	744
ACT	54,394	8,423	67,413	26,331	953	1,435
Australia	**2,992,212**	**364,670**	**4,153,948**	**1,555,134**	**60,548**	**91,129**

Use of recovered ferrous and aluminium in Australia, 2006
Contamination rates at recovery facility

Ferrous	Local car parts, cans, rolled steel for export, corrugated iron etc
Aluminium	Aluminium cans, ingot to auto, valves, castings, ingot for export

Ferrous	4.2%[4]
Aluminium	5%[4]

Critique and Need for more comprehensive system

Emphasis on collecting end of life goods and infrastructure components, and recycling materials from them after they are about to go to landfill.

Initial and ongoing driver: avoid landfill.

Some substances are lost in bulk recovery of Fe, Al; e.g. Cu, Zn, Pb;
or contaminate these recovered substances; including P in MBT composting.

Some more comprehensive approaches:

Industrial ecology: but emphasis on manufacturing waste cycling to other manufacturers.

Alcoa: allow others to collect and separate Al from EoL goods…don't know about these goods.
ARA: Sims + Nyrstar: 60% of ULABs for Pb in Australia; sell back to LAB manufacturers.

Fuji-Xerox: very good: sell service, retain ownership of good, component re-use and substance recycling….they know their goods.

Sustainable metals management in Australia: Research questions and goals

- Where are the sinks for Cd, As, Hg contamination in Australian metal concentrates exports to China, Japan, Korea, Taiwan?

- How much stock of metals in tailings and smelter slags in Australia; where are they; are they economically stored for future recovery?

- Urban mining of metals in infrastructure stock in cities:
  - how much metals,
  - where are they,
  - what are our current overall recycling rates,
  - how can they be more efficiently recovered (eg Pb in ULABs currently 92%)?

Sustainable metals management in Australia: Research questions and goals

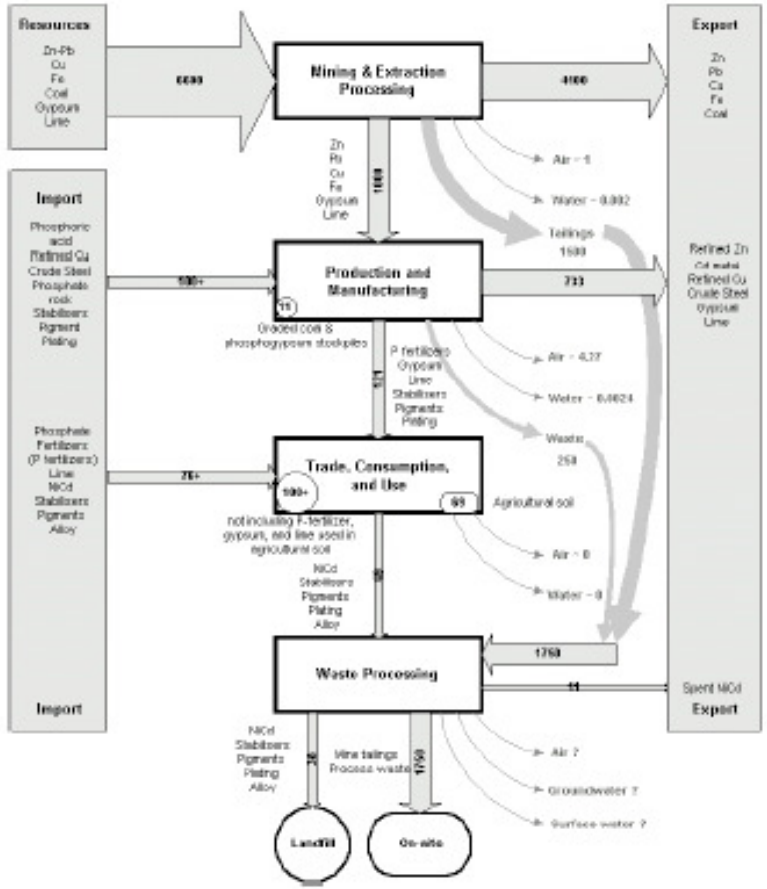
- What business models support metal stock information retention, and how can metals best be cycled?
  - Alcoa collection of Al scrap from end of life goods scap companies
  - Fuji-Xerox photocopiers leasing arrangement
  - -> Can resource companies retain ownership of the metal, and rent its use?
  - OR, is this a specialist urban mining prospect?

Substances analysed in Australia and Sydney

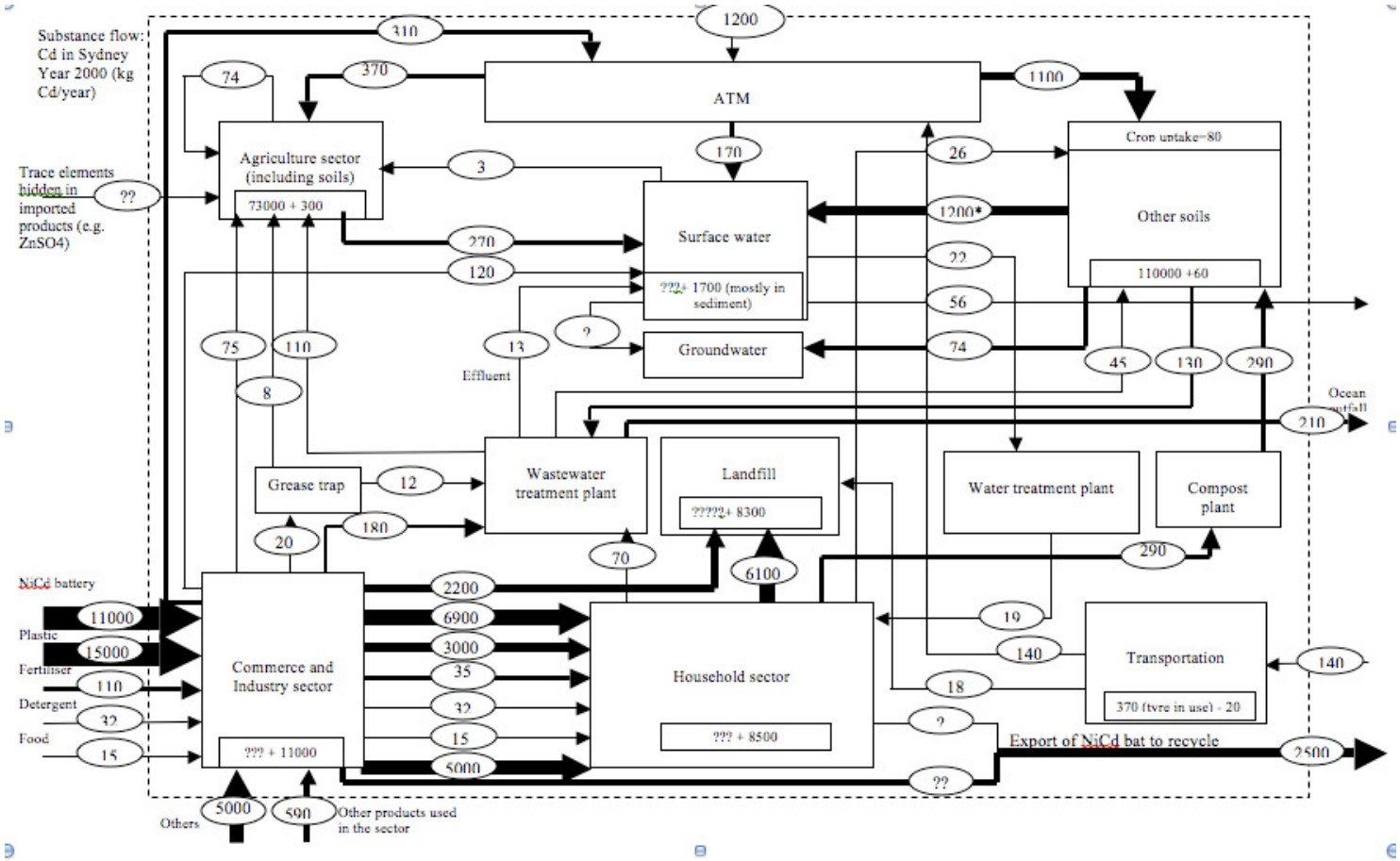
detailed in PhDs; initial in honours/masters projects

Metals	Nutrients	Carbon
Cd Hg **As**	**P** (only Sydney)	Only Sydney
Pb Zn Cu Fe Al Mn Cr	**P**(only MIA)	

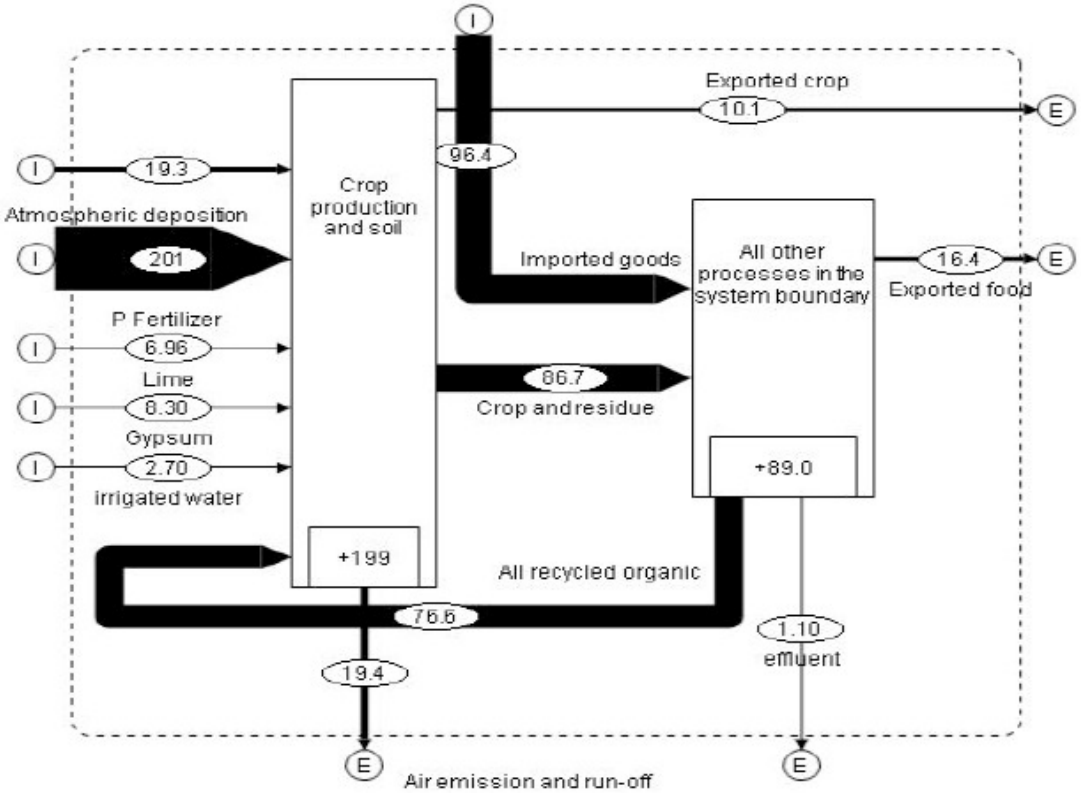
Cd in Australia, tonne, 1998/99



Cd in Sydney, 2000, Kg/yr



Cd balance in MIA 2006, kg



Cd balance in the Murrumbidgee Irrigation Area, 2006, Kg

Application of GIS with Cd loading on soils over 10 years

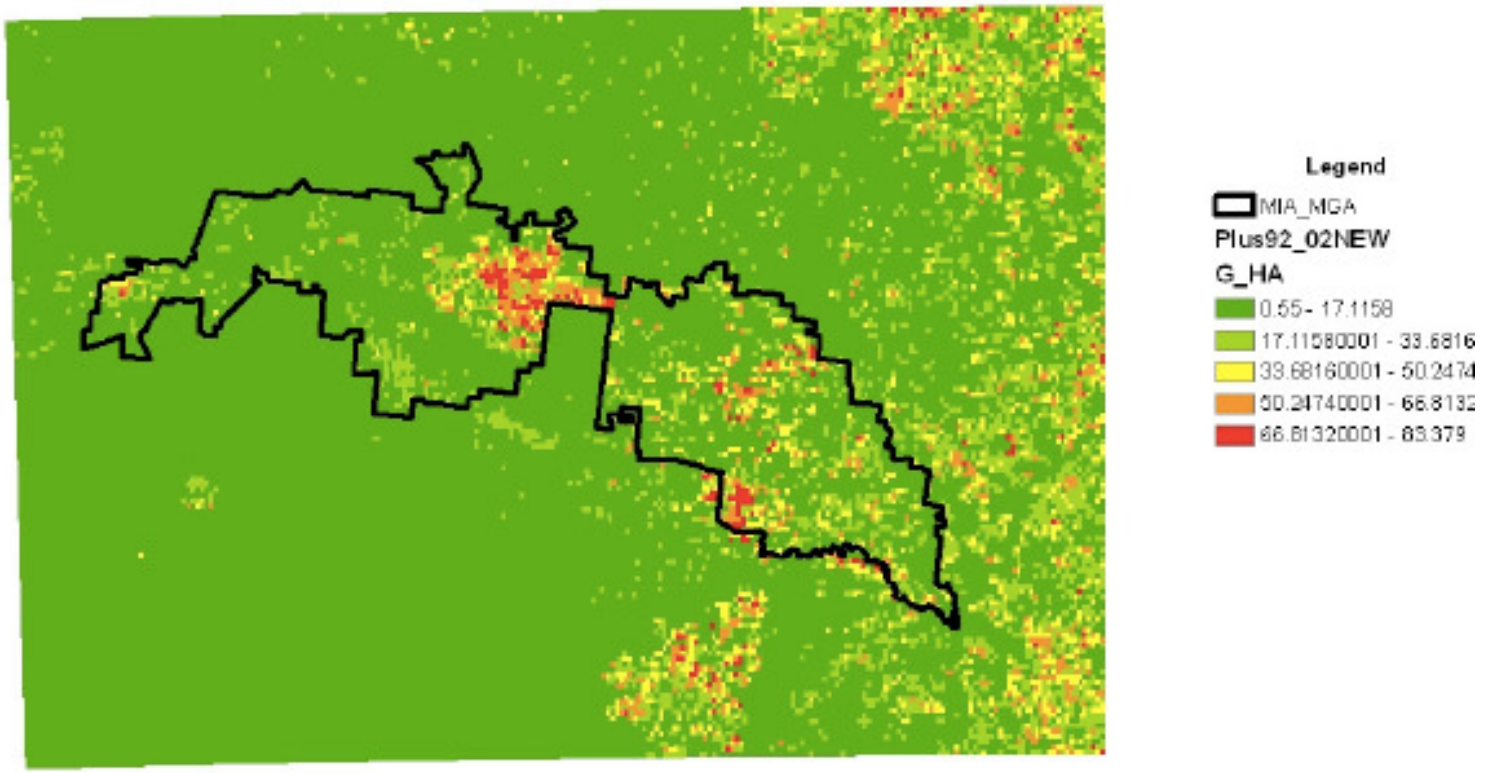
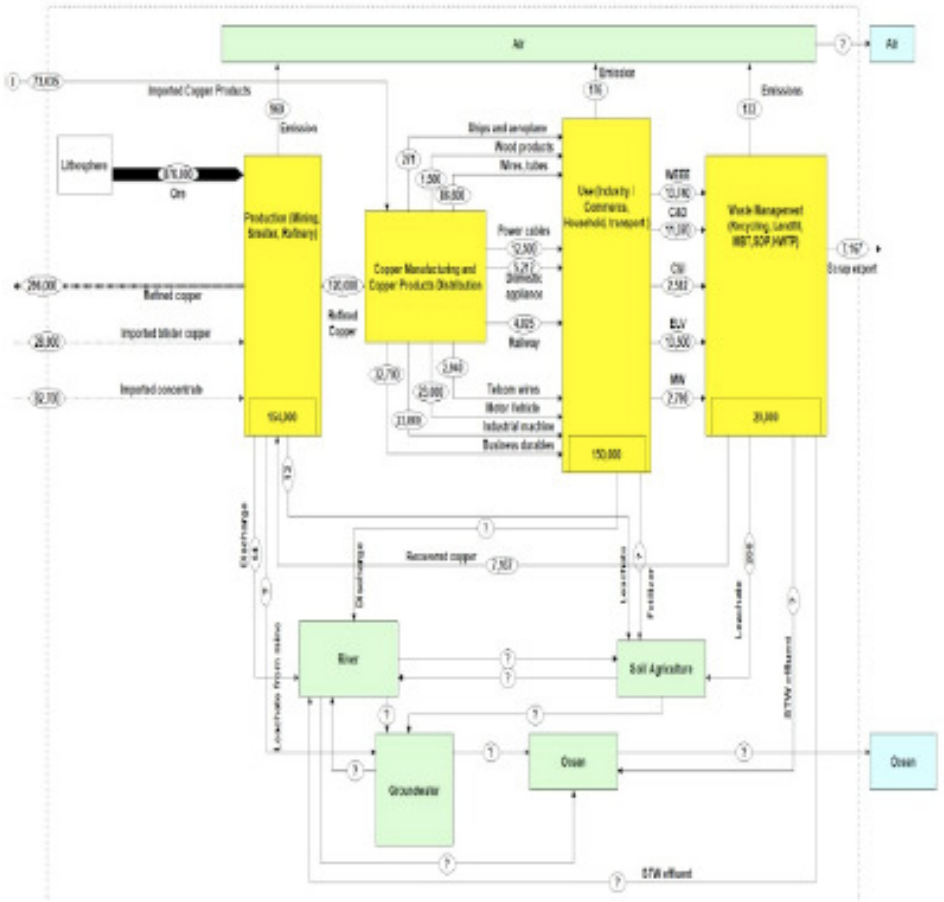
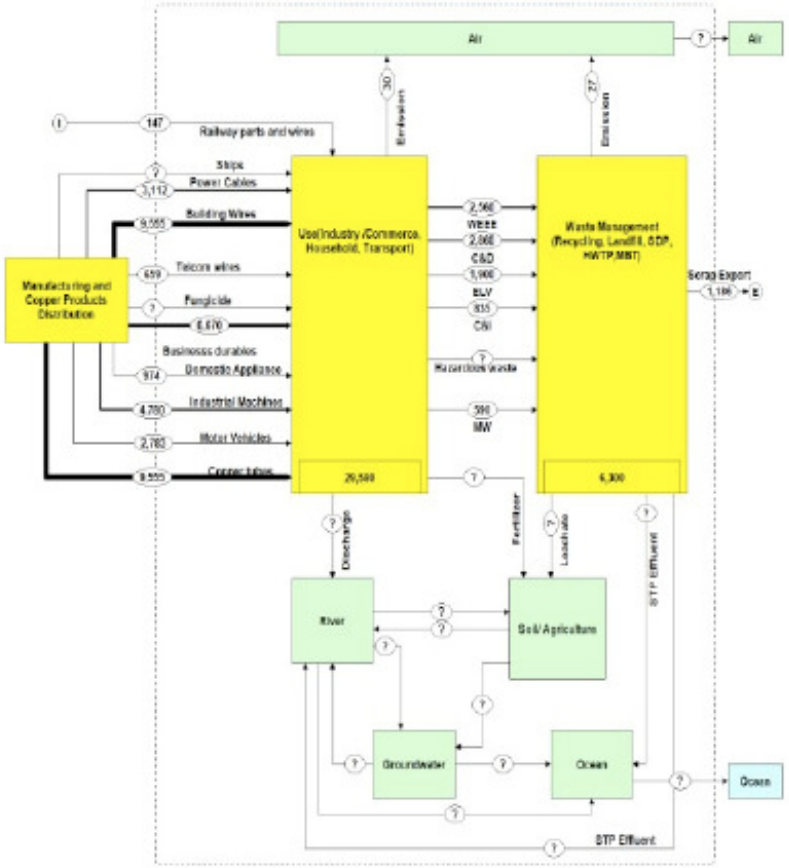


Figure 7.6: Spatial accumulated net Cd balance in MIA (1992-2002) (g/ha)

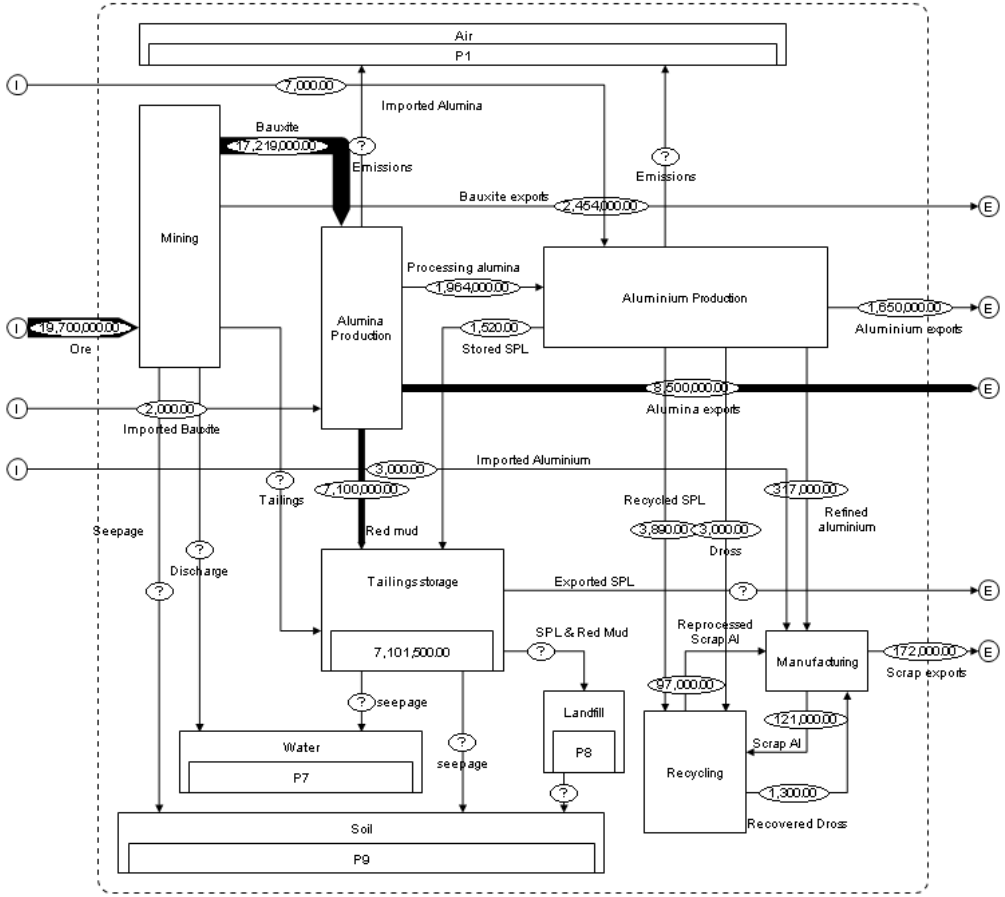
Cu in Australia, 2008 tonnes



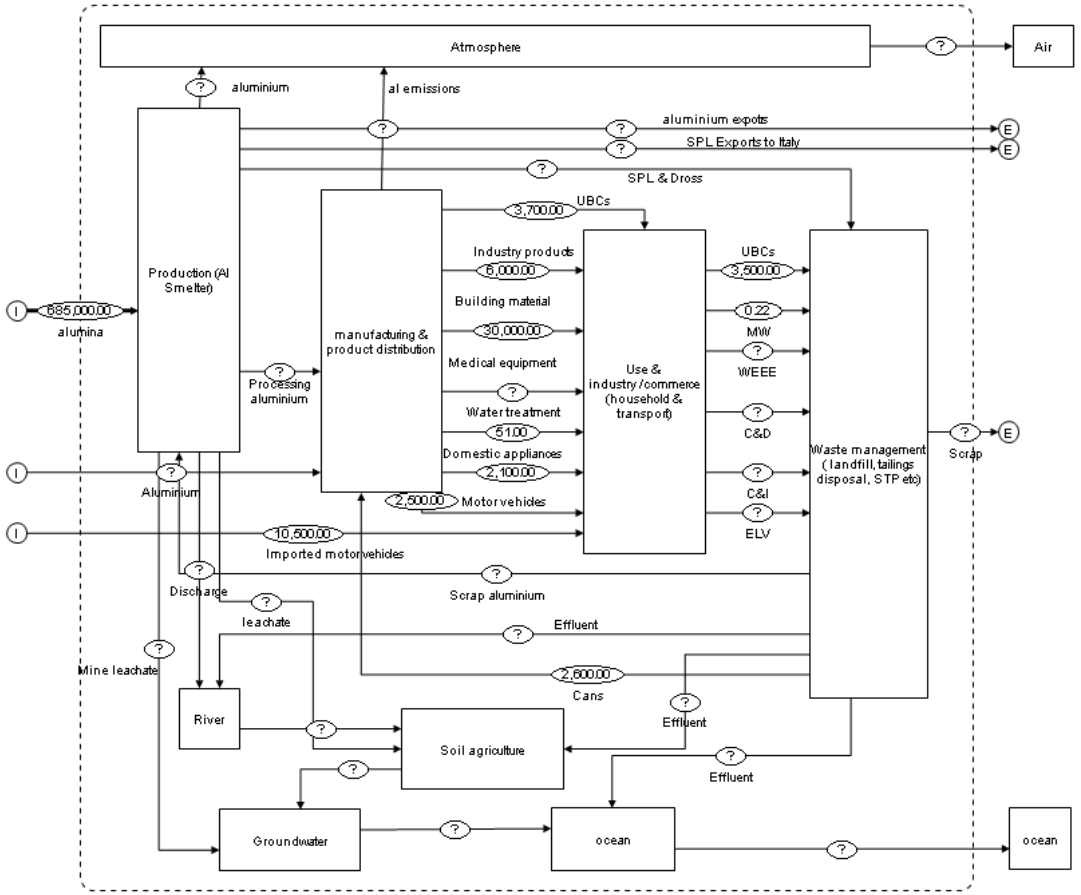
Cu in Sydney, 2008 tonnes



Aluminium Australia 2007-08, tonne,



Aluminium Sydney 2007-08, tonne



The Future


Indonesia
Jakarta
Java Sea
Banda Sea
Arafura Sea
Timor Sea
Darwin
Bismarck Sea
Papua New Guinea
Solomon Sea
Coral Sea
Cairns
Townsville
Mackay
Northern Territory
Queensland
Rockhampton
Gladstone
Bundaberg
Maryborough
Sunshine Coast
Brisbane
Tweed
Australia
Western Australia
Geraldton
Kalgoorlie
Perth
Bunbury
Albany
South Australia
Tamworth
Port Macquarie
New South Wales
Newcastle
Sydney
Canberra
ACT
Adelaide
Mildura
Wagga Wagga
Victor Harbor
Albury
Victoria
Great Australian Bight
Warrnambool
Melbourne
Tasman Sea
Tasmania
Hobart
New Zealand
Timaru